Pattern Recognition Using Computer Vision

Sujata Labhade, Nikita Chavan, Dr. Bombale G. R., Prajakta Dukale, Aarti Thorat, Yogita Somase
Department of Computer Computer Engineering, S.N.D. COE & RC, Yeola Yeola, Maharashtra, India

***Abstract*—This project, "Pattern Recognition using Computer Vision" focuses on developing a system capable of identifying and interpreting patterns in visual data through the use of machine learning algorithms. The goal is to address the limitations of traditional pattern recognition systems, such as low accuracy and inefficiency, by leveraging Logistic Regression. The proposed system will be evaluated on various datasets, with potential applications in fields such as healthcare, security, and autonomous vehicles. Pattern recognition is a fundamental aspect of computer vision, enabling machines to interpret and understand visual data by identifying patterns, objects, or features within images. With the advent of deep learning the field has seen significant advancements, leading to more accurate and efficient systems. This project focuses on leveraging these advancements to develop a comprehensive pattern recognition system that can be applied in various real-world scenarios, including image classification, object detection**

Keywords: Pattern Recognition, Computer Vision, Logistic Regression, Feature Extraction, Model Accuracy

I. INTRODUCTION

The growing demand for intelligent systems capable of understanding and interpreting human activities has led to significant advancements in the fields of pattern recognition and computer vision. This research focuses on leveraging Logistic Regression (LR) in pattern recognition to develop an efficient, interpretable, and scalable model for human activity recognition. By classifying visual data from images, our approach identifies and categorizes human activities based on their unique patterns and features, either through raw pixel values or extracted visual cues. Human Activity Recognition (HAR) is challenging yet crucial for applications across healthcare, surveillance, and human-device interaction. Existing methodologies often rely on neural networks, which, while effective, can be complex and resource-intensive. In contrast, this research proposes a Logistic Regression Perception Network aimed at simplifying activity recognition tasks while maintaining accuracy. Our model aims to predict human actions by utilizing statistical approaches and historical data for informed pattern recognition. Through this approach, we contribute to the development of a lightweight, real-time solution for human activity classification that can be effectively applied in various fields where rapid and reliable activity recognition is essential. Logistic Regression (LR) is one of the most fundamental and widely used algorithms in the field of machine learning and pattern recognition. Despite its name, it is primarily used for classification tasks rather than regression, making it a powerful tool for binary classification and, with extensions, for multi-class classification problems. In the context of computer vision, where the objective is often to classify or recognize patterns within images, Logistic Regression plays a key role in simplifying complex tasks into manageable problems. Pattern recognition involves identifying patterns, structures, or regularities in data, and one of the most common applications of this field is image classification, where the goal is to label images based on their content (such as identifying objects, faces, or digits). Computer vision, a subset of artificial intelligence (AI), deals with enabling machines to interpret and make decisions based on visual data, typically in the form of images or videos. Logistic Regression serves as a foundational technique in such tasks, providing a simple yet effective approach to image classification problems.

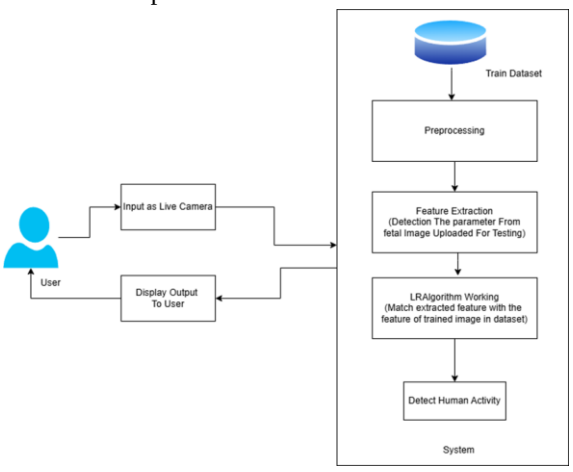


Fig. System Architecture

1. User Input
   - The user provides input using a live camera (like a webcam).
   - This live camera captures the real-time image or video.
2. Pre-trained System
   - On the system side, there's a trained dataset already prepared.
   - It goes through the following steps:

a) Pre-processing
   - This step cleans and prepares the data/images from the dataset so that they're ready to be used for training and comparison.

b) Feature Extraction
   - The system looks at the input (live image) and extracts important features (like shapes, patterns, etc.).
   - It also detects specific parameters from the image for testing.

c) Logistic Regression Algorithm (LR Algorithm)
   - The system uses a machine learning algorithm (Logistic Regression in this case).
   - It compares the extracted features from the live input image with the features from the pre-trained dataset.

3. Output Detection
   - After comparison, the system detects the human activity (e.g., sitting, walking, waving, etc.).
   - The result is displayed back to the user.

II. PROBLEM STATEMENT

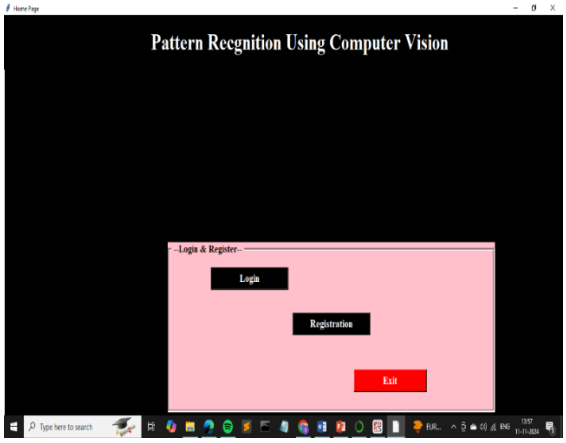
- ❑ Recently to detect and identify human Activity is so difficult. So, we are going to implement an proposed model for a Logistic Regression (LR) Perception Network on image processing.
- ❑ Traditional methods struggle with accuracy and real-time performance.
- ❑ Need for a system that is fast, efficient, and applicable in multiple domains.

III. METHODOLOGY

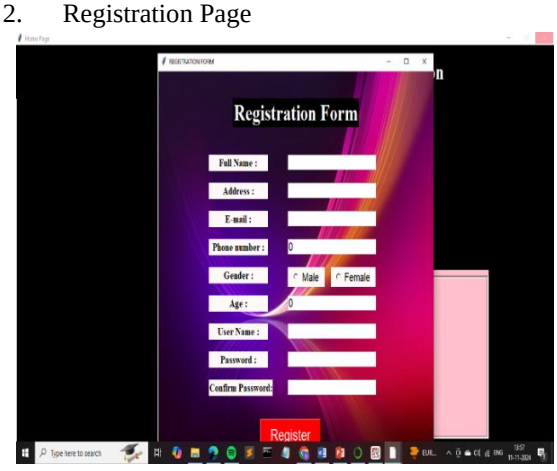
- ❑ Data Preprocessing:
  - Collecting images/videos from datasets or real-time camera feed.
  - Applying image enhancement techniques (grayscale conversion, noise reduction).
- ❑ Pose Estimation Model:
  - Using OpenPose, PoseNet, or MediaPipe to extract body keypoints.
  - Converting detected keypoints into numerical vectors for further processing.
  - Feature Engineering:
  - Extracting key features such as joint angles, movement speed, and relative position.
  - Normalizing and structuring data for classification
- ❑ Machine Learning Model:
  - Applying Logistic Regression to classify movements.
  - Training the model using labeled dataset (standing, sitting, punching, kicking, etc.).
  - Evaluating accuracy using Confusion Matrix & Precision-Recall Analysis.
- ❑ Real-Time Implementation:
  - Deploying the trained model for real-time activity detection.
  - Displaying results via GUI (Tkinter) or Web Interface.

IV. RESULTS

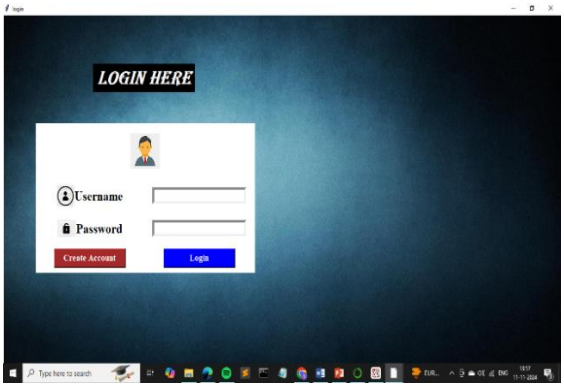
1. Home Page



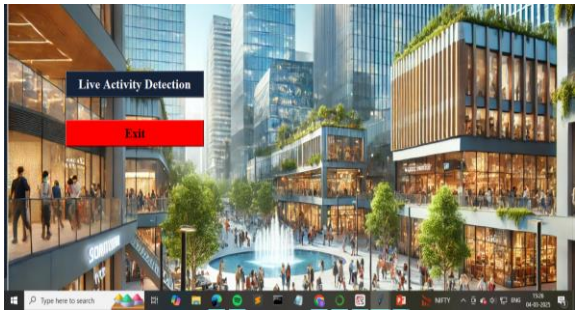
2. Registration Page



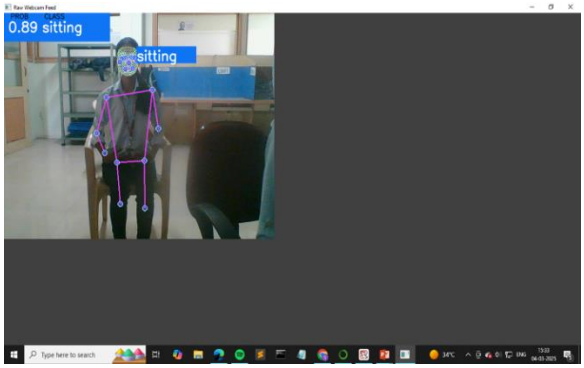
3. Login Page

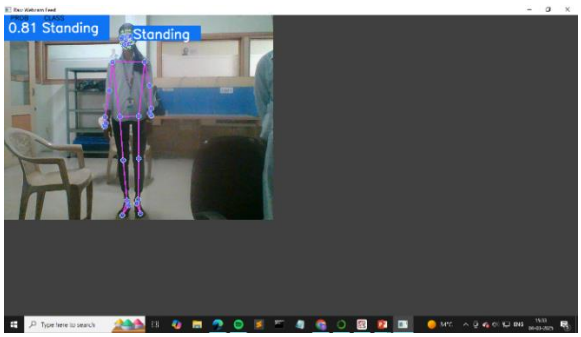


4. Live Activity Detection



5.





V. CONCLUSION

All The project successfully demonstrates the potential of machine learning and computer vision in revolutionizing pattern recognition systems. By overcoming the limitations of traditional methods, the developed model offers enhanced accuracy, efficiency, and versatility. The project not only contributes to the academic understanding of computer vision but also opens avenues for practical applications in various industries. Regression can serve as an effective method for simpler, real-time pattern recognition applications, particularly when the goal is to quickly deploy a lightweight, interpretable solution with reasonable accuracy.

VI. ACKNOWLEDGEMENTS

The We would like to express our gratitude to Dr. Bomble G. R. , HOD of the Department of Computer Engineering, S. N. D. College of Engineering & Research Center, Yeola for his continued support in our project work.

REFERENCES

[1] Zhang W, Sun W. Research on small moving target detection algorithm based on complex scene[J]. Journal of Physics: Conference Series, 2021, 1738(1):012093 (5pp).

[2] Gao X, D Ge, Chen Z. The Research on autopilot system based on lightweight YOLO-V3 target detection algorithm[J]. Journal of Physics: Conference Series, 2020, 1486(3):032028 (6pp).

[3] K. Zhao, X. Jin, J. Ji, J. Wang, H. Ma, and X. Zhu, “Individual identification of holstein dairy cows based on detecting and matching feature points in body images,” Biosystems Engineering, vol. 181, pp.128–139, 2019.

[4] B. K. Reddy, S. Bano, G. G. Reddy, R. Kommineni, and P. Y. Reddy, “Convolutional network based animal recognition using yolo and dark-net,” in 2021 6th international conference on inventive computation technologies (ICICT). IEEE, 2021, pp. 1198–1203.

[5] T. Diwan, G. Anirudh, and J. V. Tembhurne, “Object detection using yolo: Challenges, architectural successors, datasets and applications,”multimedia Tools and Applications, vol. 82, no. 6, pp. 9243–9275, 2023.

[6] F. Ciaglia, F. S. Zuppichini, P. Guerrie, M. McQuade, and J. Solawetz, “Roboflow 100: A rich, multi-domain object detection benchmark,” arXiv preprint arXiv:2211.13523, 2022.

[7] S. Prabhu, M. Sreenath, V. Malavika, H. Om, and S. Swetha, "Detectionand recognition of animals using yolo algorithm," in 2023 International Conference on Distributed Computing and Electrical Circuits and Electronics (ICDCECE). IEEE, 2023, pp. 1–6.

[8] Face Recognition with DLIB, 2023. Retrieved from https://github.com/ageitgey/face_recognition

[9] S. Manoj, S. Rakshith, and V. Kanchana, "Identification of cattle breed using the convolutional neural network," in 2021 3rd International Con-ference on Signal Processing and Communication (ICPSC). IEEE, 2021, pp. 503–507.

[10] Google Vision OCR API, 2023. Retrieved from https://cloud.google.com/vision/docs/ocr

[11] Text Analysis and Visualisation of The Observatory Review from Hong Kong Early Tabloid Newspaper, 2022. Retrieved from https://dsprojects.lib.cuhk.edu.hk/en/projects/hong-kong-early-tabloidnewspapers/tabloid-introduction/